

heart was identified as the mechanism responsible for this phenomenon.⁵ The importance of specifying the phenomenon to be explained is illustrated with this example: Until the heart was recognized as performing the function of pumping blood, there was no interest in understanding the way in which this occurred. Moreover, hearts also do other things – they make sounds and someone might want to explain that phenomenon. That, however, is a different phenomenon that involves a different mechanism – a system of parts and operations that presumably shares some components with the mechanism for pumping blood but is not identical to it.

Component Parts and Component Operations

The next aspect of mechanisms to emphasize is that mechanisms consists of component parts and component operations.⁶ Figure 2.2 illustrates key components of the heart viewed as a mechanism for pumping blood. Component parts of the heart include the atria and ventricles, the valves between the atria and ventricles and between the ventricles and arteries, and the blood itself. Component operations include the contraction and relaxation of the atria and ventricles and the opening and closing of the valves. Blood is forced out of the atria and ventricles as they contract, and prevented from flowing back by the closing of the valves afterward.⁷ The blood here is a part of the mechanism, but one that is operated on rather than itself performing operations (in the context of this phenomenon). Although in this case the parts that perform

⁵ In many cases, however, the entity or system responsible for the phenomenon is not immediately obvious and must be discovered. For example, in Bechtel and Richardson (1993), we discussed the extended controversy in the nineteenth century of the locus of control for respiration until Pflüger (1875) established that it occurred within individual cells.

⁶ When I am emphasizing the thing performing the operation, I use the term *part* or *component part* and when I am emphasizing what the part does, I speak of *operation* or *component operation*. I sometimes use the term *component* alone where it is not important to be specific, or to designate jointly the part and the operation it performs.

⁷ Machamer, Darden, and Craver employ the term *activity* to draw attention to the fact that components of mechanisms are active. The mechanical philosophy of the seventeenth century departed from Aristotelian philosophy in construing elements of nature as passive, doing something only if acted upon. In some accounts, the giant clock-like machine of nature was wound up at the outset and motion in the world is the playing out of that initial state. The term *activity*, however, does not readily capture the fact that in most operations there is also something acted upon. This is the reason I have preferred the term *operation*. Typical of the operations I have in mind are the reactions of chemistry which prototypically involve a catalyst, a reactant, a product, and often a cofactor. In some reactions there is no need for a separate catalyst as the energetic factors are such that the reaction will occur spontaneously. In autocatalytic reactions, which are highly relevant in living systems, the product of the reaction also serves as a condition for more iterations of the reaction.